REMEDIATION WASTE TREATMENT PROCESSES

(deletions from the previous version are shown in strike-through font, additions in italics)

I. CRITERIA FOR TREATMENT PROCESS:

Process Criteria for Treatment

- The treatment proposed shall be the minimum treatment needed to meet *acceptance and* performance criteria established for the ~~closure~~ *treatment product (waste form).*
- Land Disposal Restrictions do not apply to the treatment product.

Performance Criteria for Treated Waste Form

a) The waste form shall not, prior to placement, contain free liquids. Demonstration of lack of free liquids shall be accomplished with the Paint Filter Test.

~~b) The waste form shall not be monolithic. All waste form particles shall pass a 3 inch mesh screen.~~

~~c) The waste form particles shall not agglomerate during storage after production such that particles larger than allowed in b) above are formed, unless such oversized particles can be reduced in size to meet the requirement in b) with normal application of hand tools or through the soil blending process.~~

b) The waste will be acceptable delivered in either monolithic or particulate form. In the event that the producer intends to deliver the waste as a mixture of both forms, the producer shall identify, at the completion of the treatability study, the ratio of one form with respect to the other and the expected order of delivery; that is, consistent mixture or campaigns of one form followed by the other.

If monolithic, the following criteria apply:

1. *Each monolith shall fit entirely within a rectilinear envelope which is a maximum of 12 inches by 24 inches by 48 inches.*
2. *Compressive strength of the form shall not exceed 3000 pounds per square inch (psi). Shear and tensile strengths shall not exceed those of 3000 psi non-reinforced structural concrete.*
3. *The monoliths shall not be reinforced.*
4. *The monoliths shall not be delivered in molds, containers, or packaging of any kind that cannot be returned to the producer.*

If particulate, the following criteria shall apply:

5. *All waste from particles shall pass a 3 inch mesh screen.*
6. *The waste form particles shall not agglomerate during storage after production such that particles larger than those allowed in 5 above are formed, unless such oversized particles meet all criteria identified for a monolithic waste form and the producer explicitly states that such agglomeration is likely.*
7. *The is no criterion for particle size distribution.*

~~c~~*d*) The waste form as received *(if particulate) or as size-reduced (if monolithic or agglomerated particulates)* shall be capable of mixing with the site soils such that no agglomerates larger than those allowed in b) are formed.

~~d~~*e*) The waste form shall be maximally resistant to dispersion by wind. Dispersion resistance can be accomplished through control of moisture content of the as-delivered form, through control of the particle size of the form, or through other acceptable control of other intrinsic waste form characteristics.

~~e~~*f*) *Except as noted below,* the waste form shall be such that delivery of the form to the remediation site is accomplished "just in time" *so that placement of a homogenous soil/waste mix is not interrupted and* so that storage of the waste on *the construction* site is minimized. *Relief from this requirement is possible if it can be demonstrated that during storage in small piles at the remediation site, the waste form will not produce dust or dispersible fines and will not degrade upon wetting, and if it can be demonstrated that the form can be transported from pile to point of placement, mixing, or size reduction using equipment already present to support remediation construction and without generation of dispersible fines.*

~~f~~*g*) The waste form shall contain no additional materials that, either because of quantity or character of the materials or both, cause existing assessment of modeling of health effect, contaminant migration, or ground water protectiveness to become invalid and that cause the currently proposed remedy to fail to adequately protect human health and the environment.

~~g~~*h*) The waste form shall be treated or prepared such that pathogens are removed or rendered innocuous to the extent that workers exposed to the material, and not wearing protective equipment, will be protected from effects of such pathogens.

~~h~~*i*) The waste form shall be treated or prepared such that gas production from the form, in type, rate, and volume, shall be no greater than such production from an equivalent volume of natural soil from the site.

i) The total volume of the waste form shall not exceed 20,000 cubic yards.

j) Leachate from the waste form, when modeled through the HELP and VS2DT codes, shall not exceed the concentrations specified for protectiveness of human health and the environment at the toe of the engineered barrier. Specification of leachate will be developed from estimated parameters resulting from early modeling and confirmed with empirical data from treatability studies.

II. *REMEDIATION WASTES* ~~SLUDGE~~ TO BE TREATED

The pond sludge consists of all waste ~~removed~~ from Ponds 207 A, 207 B series, 207 C, and the Unit 48 Clarifier *managed for the purpose of implementing corrective action.*

Pond sludge removed during corrective action but prior to September, 1993, has been treated to the form "pondcrete". About half of that material was disposed off-site. Existing characterization data will be used to describe the remainder of the waste which is still in storage at Rocky Flats. The stored, or inventory, pondcrete, including elements of packaging, will be dispositioned in the Phase I remediation.

The sludge *that remained in the ponds and Clarifier in September, 1993, is being* ~~will be~~ transferred to the 750 Pad storage tanks. Minor amounts of debris from the ponds, mostly rocks, is being stored in crates. Excess water will be decanted from the sludge only as operationally convenient to ensure adequate storage space in the tanks on-hand. The existing characterization data, as modified to reflect the tank storage configuration, will be used to describe the sludge. Some sludges may be co-mingled as a function of storage

decisions. *The sludge will be dispositioned in the Phase I remediation*

III. SELECTED TREATMENT PROCESS

~~Ex-Situ mixing of sludge with OU 4 soils: Pond sludge, including the solids and water, will be retrieved from the 750 Pad storage tanks and blended with lime, flyash, and soil excavated from the OU 4 impoundments and surrounding areas.~~

~~Minor amounts of pond contents stored in crates contain particles that exceed the size/agglomeration criteria. This material will be treated, if necessary, to meet all other performance criteria and physically processed at the construction site in the same manner as soil material that exceeds the size/agglomeration criteria.~~

~~Benefits: Cheap; easily designed, fabricated, installed and operated.~~

~~Quick; allows for processing sooner~~
~~Acceptable; will be in compliance at the Point of Delivery.~~

~~Disadvantages: Public Perception: Untreated, sludge and water is going back into the ground~~
~~Precedent setting: we will be first with CAMU, and will pioneer (again) regulators interpretations/applications of T. U.~~

Chemical stabilization of pond remediation wastes: *Pond sludge, including the solids and water, will be retrieved from the 750 Pad storage tanks and crates and stabilized with materials such as lime, flyash, and pozzolons. Previously treated pond sludge (pondcrete) would be size-reduced, including internal packaging and adsorbents in the pondcrete containers, and similarly stabilized. The absorbent to be added in the FY95 repackaging activities is expected to be added in a manner that will allow that absorbent, probably Stergo, to be removed and disposed separately. Recipes will be decided by treatability studies. Resulting waste product will be size-reduced as necessary and mixed with soil for placement at the construction site.*

Benefits: Simplified logistics due to much less material to move to and from the construction site than alternatives using site soil.
Lessened volume of inputs and product at the treatment unit will allow surge capacity for longer production run.
Chemical stabilization a more aggressive treatment than simple absorption, should be more acceptable to regulators and public.
By including soil mixture at construction site, avoids rigorous quality control of product.
Uses existing construction size-reduction and mixing equipment (though may increase size or amount of equipment needed for the closure construction).

Disadvantages: More complex treatment required than simple absorption

IV. REJECTED ALTERNATIVE TREATMENT PROCESSES

a) Pondcrete pellets: The existing-design HNUS pondcrete process will be modified to produce 1 inch pellets rather than monoliths.

Benefits: Treatment of sludge and water to LDR's completed, existing equipment design could be used with modification, some existing equipment is available as GFE.

Chemically stabilizes the waste. A true chemical stabilization and solidification (CSS).

Disadvantages: Highest cost; labor intensive; process control system is the most complex.

Intense quality control effort would be needed.

Expensive; time consuming; new technology (pelletizing) to be added to existing design.

Fails the Process Criterion for minimal treatment, in that the pondcrete process was designed to produce LDR-compliant waste.

b) In-situ sludge and soil mixing: Transport the liquid sludge to the construction site and incorporate the liquid directly into the lifts of contaminated materials (with, for example, a roto-tiller) after the lift material is spread but before compaction.

Benefits: Most simple process
Least estimated cost
Produces least volume increase in burial cell
Easy, quick

Disadvantages: Fugitive emissions are a concern
State and Public acceptance expected to be low
Control of free liquids *more difficult*
Transportation risk of liquid spill
Additional unknown QA/QC complexities "ensuring" the process meets performance criteria

c) Dewatering sludge - place "filter cake" in closure, mix with soil

Benefits: Filtration study completed for A/B sludge

Disadvantages: No filtration study completed for C Pond materials
Filtration unit estimate high cost, long lead time
Estimate will dispose of only 30% of sludge volume
Filtrate would contain 30-40% dissolved solids; would choke Building 374 for several years and produce approximately 4,000 1/2 crates of saltcrete for disposal.
Only very limited design work done.

d) Mix sludge with soils only

Benefits: Readily available, estimate relative low cost
Relatively simple process
Could meet some of the WAC/PS

Disadvantages: Expect State and public acceptance to be low
Cost savings over selected process appear minimal

e) Ex-Situ mixing of remediation wastes with OU 4 soils: This alternative was previously judged acceptable, but further qualitative analysis has revealed additional disadvantages. For this alternative, pond sludge, including the solids and water, will be retrieved from the 750 Pad storage tanks and blended with lime, flyash, and soil excavated from the OU 4 impoundments and surrounding areas. Pondcrete will be size-reduced and similarly treated.

Minor amounts of pond contents stored in crates contain particles that exceed the size/agglomeration criteria. This material will be treated, if necessary, to meet all other performance criteria and physically processed at the construction site in the same manner as soil material that exceeds the size/agglomeration criteria.

Benefits: *Cheap; easily designed, fabricated, installed and operated.*
Quick; allows for processing sooner
Acceptable; will be in compliance at the Point of Delivery.

Disadvantages:

Public Perception: Untreated, sludge and water is going back into the ground and soils

Logistics complex; requires roughly 3500 truck loads of soils to be delivered to the treatment units and 7000 truck loads of treated wastes to be returned to the construction site. The larger volume makes it more difficult to meet the "just in time" criterion, and attempts to engineer around the "just in time" criterion require producing a final waste form to narrower and more rigorous performance standards.

Increases complexity of specifications, since the physical parameters of the soils must now be controlled as an input to the treatment units.; increases complexity of quality assurance.

Increases complexity of treatability study, since at least three soil types require evaluation

Compared to alternatives that do not include use of OU 4 soil in the treatment, increases the number of times contaminated soil is moved and increases vehicle movement within and in and out of the construction zone, which make dust control more difficult.

Sub-alternative: Place the waste component as a "thin" layer within the contaminated media cell. While a horizontally uniform layer would decrease the need to address differential settling calculations, it would increase complexity by narrowing the window for "just-in-time" delivery. Rejected.

CONSIDERATION OF CONSTRUCTION-GRADE TREATED WASTE

Several potential justifications for the expense and complexity of producing construction-grade wastes were considered:

- Could construction-grade waste be viewed as an enhancement under §264.552 (Corrective Action Management Units (CAMU))? We see no regulatory benefit, but no harm to DOE's regulatory position would occur. Under §264.552(b)(ii), regulated units may be incorporated into a CAMU when such inclusion enhances the remedy; this is relevant to the units in Building 788 and Building 964 and to the inclusion of the pond impoundments. Inclusion of the pond wastes is related to the definition of "remediation waste" and to treatments that enhance long-term effectiveness through reduced toxicity, mobility, or volume. Based on previous comments from the State, it is possible their comfort level with the proposed remedy could be enhanced by the use of the treated waste as a structural component, but that is not clear.

- Could construction-grade waste give the State a higher comfort-level that would facilitate their acceptance of the proposed remedy? While this consideration is primarily political in nature, State acceptance is included in the National Contingency Plan (NCP) criteria for evaluating CERCLA remedies and so is a justifiable cinderation in DOE's decision-making. In the absence of a statement from decision-makers in the State, we have no basis for evaluating their comfort-level.

- Could construction-grade waste be viewed as an effective substitute for a commercial product (gravel) under §261.2(e)(ii)? Such an interpretation may not be technically possible: The waste components are not needed or desirable in a gravel, and legitimate reuse cannot be a "use constituting disposal". The material could only be used within the contaminated media cell of the closure (that is, not in any of the cap layers), which could identify such a use as sham reuse.

If the State were willing to commit their support to the proposed remedy in exchange for treating the remediation wastes to construction-grade, an intangible benefit would be obtained. In the absence of a commitment from the State, we see no benefit to the project from construction-grade waste which would off-set the added complexity and resulting cost.

From the analysis above and information shown in attachment 1 for alternative a), we still recommend the "construction-grade" alternative be rejected.